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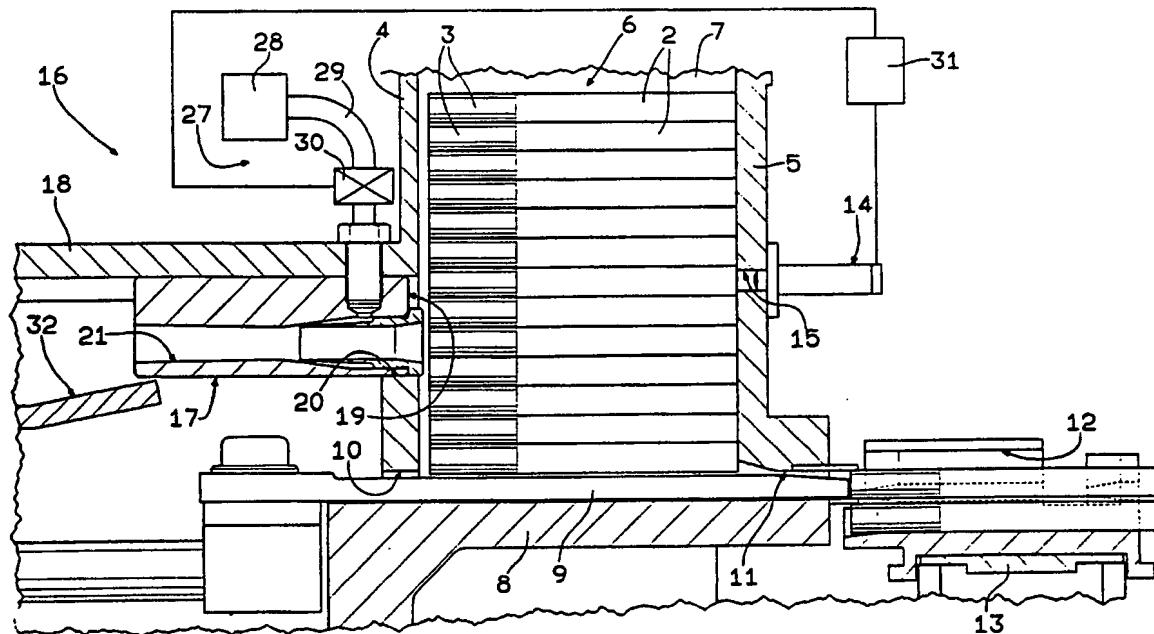
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(54) Removing single cigarettes

(57) The device makes use of a vacuum duct (17) that can be positioned in alignment with a single cigarette to be removed from an amassment of loose cigarettes arranged parallel one with another and with their two ends occupying two mutually parallel planes; the inlet end (19) of the duct (17) is offered to one end of the single cigarette, the extraction passage being at least wide enough to accommodate the width of the cigarette (2), and part of the passage (21) is embodied as a tubular nozzle (24) directed away from the inlet and connected by a valve (30) to a source of compressed air.

FIG.1

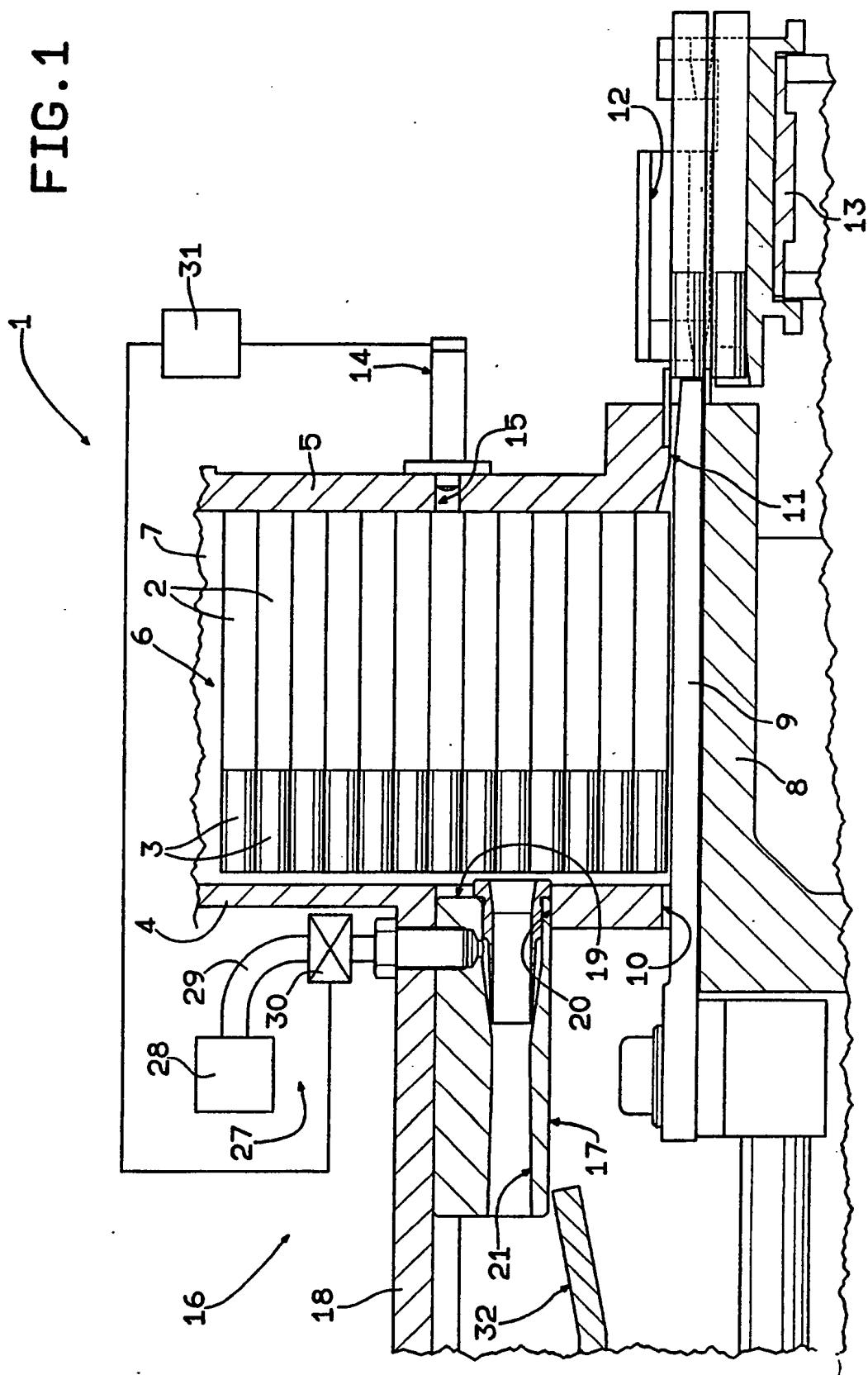


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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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FIG. 1



ENG. 2

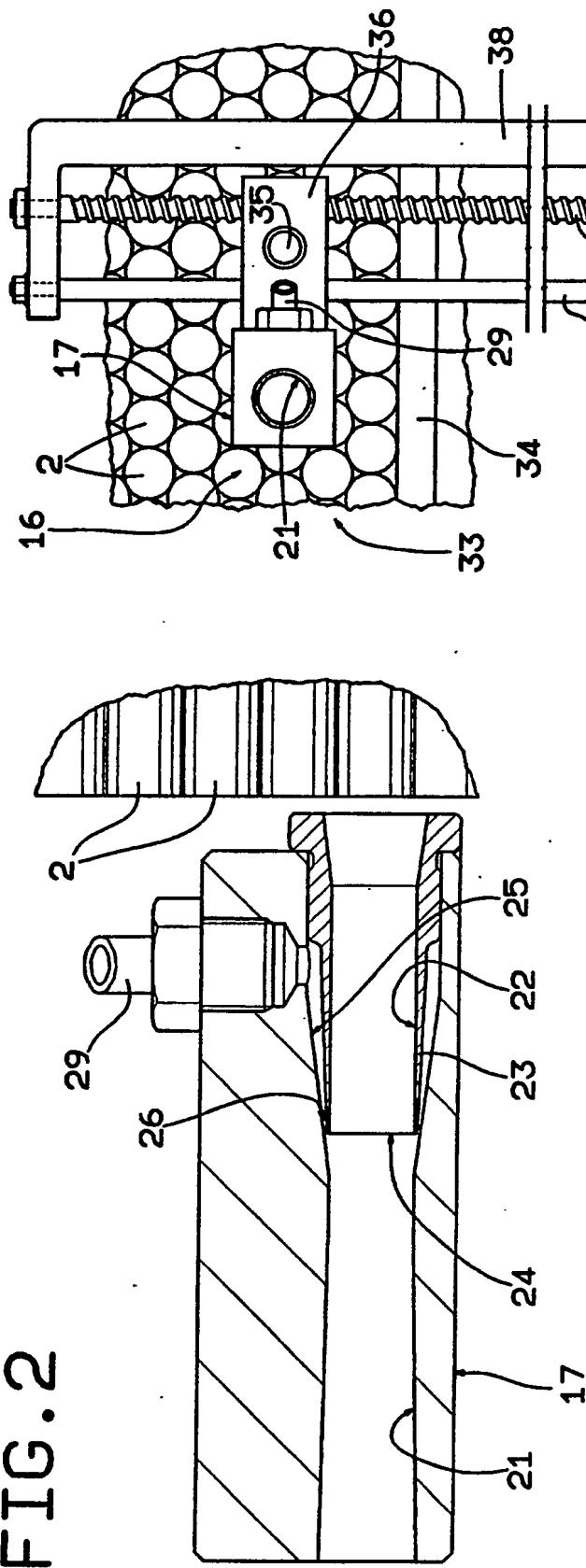
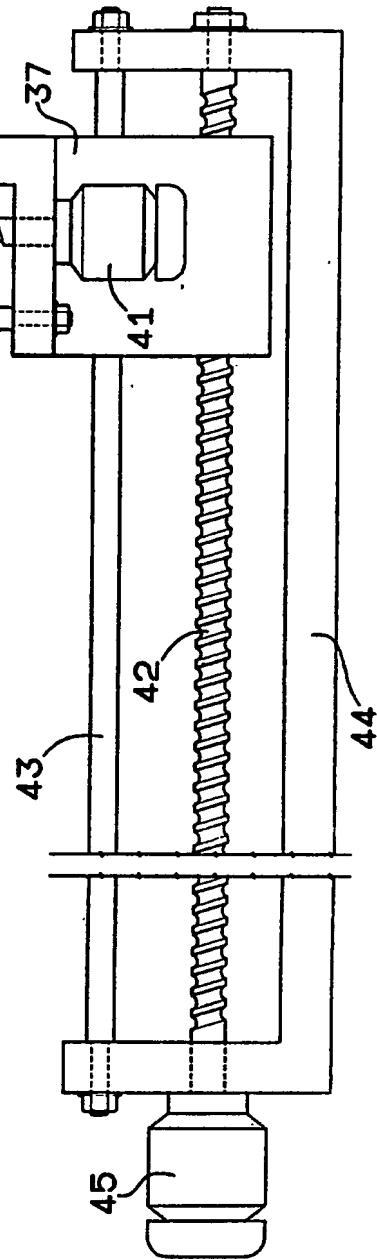


FIG. 3



# A device for extracting single cigarettes from an assortment of cigarettes

The present invention relates to a device by means of which cigarettes can be removed singly from a plurality of cigarettes amassed parallel one with another and with their opposite ends occupying two mutually parallel planes.

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A typical application of the device would be one in which cigarettes are transferred en masse from a forming machine to the infeed chute of a wrapping unit, arranged either by lots carried in special containers, or in continuous strata carried along a conveyor belt. On emerging from the chute, the cigarettes are gathered into groups, each of which comprising a number of cigarettes equal to that contained in a finished pack.

Thereafter, the cigarettes of each group undergo quality control, and any group including even one substandard cigarette is rejected.

In an attempt to reduce the number of cigarettes thus rejected, hence to obtain a notable saving in costs. a quality control device has appeared, for

example as disclosed in US patent 4 592 470, which checks the condition of the single cigarettes while still inside the chute and rejects any that are found to be substandard before their arrival at the grouping station.

05 In the device in question, cigarettes are ejected from the chute by a combination of pneumatic and mechanical means. More exactly, whenever a signal is generated by means that monitor the integrity of the cigarettes, a nozzle is made to direct a jet of air against the end of the substandard cigarette which triggered the signal.

10 Under the force of the jet, the leading end of the cigarette emerges initially through an opening in the chute and is impaled by a reciprocating needle type element, whereupon the needle distances itself from the chute and the removal of the substandard cigarette is ultimately accomplished.

15 A device of this type is beset by certain drawbacks attributable both to the pneumatic means and to the mechanical means.

20 First, the jet of air directed against the end of the cigarette tends to dislodge tobacco particles, which drop onto mechanical components beneath and 25 can inhibit their correct operation.

Second, the presence of needles, or of pricking elements in general, can constitute a hazard for the operator, especially in the event of their being broken.

05 Finally, the use of pneumatic and mechanical means in conjunction, as described above, dictates that the cigarettes must be accessible from both ends, signifying that the use of the conventional device in question is limited in general to systems that

10 utilize a chute; by contrast, where the substandard cigarettes are to be removed from a stack contained in one of the special transfer containers mentioned above, or carried on a conveyor belt, only one end of the cigarette will be accessible at most.

15 The object of the present invention is to embody an extraction device for single substandard cigarettes that remains free of the drawbacks encountered with prior art devices as described above.

The stated object is realized, according to the

20 present invention, with an extraction device for removing single cigarettes from an amassment of cigarettes disposed parallel one with another and with their opposite ends occupying two mutually parallel planes, operating in conjunction with

25 sensing means by which to verify the integrity of

the cigarettes, characterized in that it comprises:  
-an extraction duct capable of alignment with a cigarette for removal, or with which the cigarette can be aligned, with its inlet end offered to one  
05 end of the cigarette;  
-a nozzle, discharging into the extraction duct in the direction opposite to that of the inlet end, and constituting part of a pneumatic circuit which further comprises a source of compressed air and  
10 valve means located between the source and the nozzle and interlocked to the sensing means, in such a way that the valve means are piloted to open by the sensing means on discovery of a substandard cigarette, connecting the nozzle with the source of compressed air and bringing about the removal of the cigarette by way of the extraction duct.  
15 A first advantage of the device disclosed is that the removal of substandard cigarettes is brought about by vacuuming the cigarette into the duct, avoiding the use of air jets directed axially at the ends of the cigarettes, which generate dust and scatter tobacco particles as mentioned above.  
20 A further advantage is that of having dispensed with the use of needles, which if broken can prove hazardous for those operating the machine.  
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The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

05 fig 1 shows the side elevation of a preferred embodiment of the device according to the present invention, illustrated in section and partly in block diagram, applied to the infeed chute of a cigarette packaging machine;

10 fig 2 is a detail of fig 1, seen in section and in enlarged scale;

fig 3 is a schematic representation of the device of fig 1, utilized to remove cigarettes singly from a close amassment.

15 In the drawings, fig 1 shows means of supporting a plurality of cigarettes, consisting in an infeed chute 1 of conventional embodiment by which loose cigarettes 2 with filter tips 3 are supplied to a packaging machine (not illustrated).

20 The chute 1 comprises a left hand wall 4, on the side of the filter tips 3, and a right hand wall 5; the walls, disposed upright and parallel with one another, create a compartment of width marginally greater than the length of one cigarette 2.

25 The compartment is divided up into a plurality of channels 6 (one only of which is illustrated) by

partitions 7 (one only of which is seen in fig 1) spaced one from the next at a distance marginally greater than the diameter of one cigarette 2.

05 The channels 6 terminate at bottom in a horizontal platform 8, on which the descending column of cigarettes 2 in each channel 6 comes to rest. The cigarettes are ejected in groups by an indexing element 9 positioned so as to engage the filter tip ends 3 and reciprocated in a direction normal to the chute walls 4 and 5 through horizontal slots 10 and 11 fashioned one in each wall 4 and 5, adjacent to the platform 8, of which the height is equal to the diameter of one cigarette 2.

10 The indexing element 9 is capable of moving between an at-rest position, in which it remains completely outside the chute 1, and a working position (fig 1) in which it occupies the chute 1, in such a way as to push the cigarettes 2 from the channels 6 into containers 12 (one container only is shown) which are moved away on an intermittently driven conveyor belt 13, carrying the groups of cigarettes toward a packaging station not shown in the drawings.

15 A more complete understanding of the structure of the chute 1, the channels 6, the indexing element 9 and the conveyor belt 13 will be gained from the

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specification and drawings of UK patents 1 298 785 and 2 023 994.

14 denotes sensing or control means by which the integrity of the single cigarettes 2 is verified.

05 Such means 14 are shown schematically in fig 1 as a sensor of conventional type (optical, mechanical or pneumatic), designed to detect any defect in the end of the single cigarette 2 through a horizontal hole 15 in the right hand wall 5.

10 16 denotes an extraction device, installed at a height lower than that of the sensing means 14, by which substandard cigarettes 2 are removed from the chute.

15 The device 16 comprises one extraction duct 17 for each channel 6 of the chute, fastened to the left hand wall 4 by way of a bracket 18 with its inlet end 19 inserted in an opening 20 afforded by the wall itself at a point adjacent to the filter tip 3 of a cigarette 2 occupying the chute 1.

20 The duct 17 exhibits a longitudinal cylindrical bore 21 of diameter not less than the diameter of the single cigarette 2, disposed with its axis parallel to the axes of the cigarettes 2 occupying the chute 1 and at a height lower than that of the relative sensor 14; more exactly, the axis of the

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bore 21 is distanced from the axis of the sensor hole 15 by a margin equal to the diameter of one cigarette 2, or a multiple thereof.

05       The end of the cylindrical bore 21 nearest to the inlet end 19 of the duct 17 coincides with the cylindrical inner surface 22 of the tubular inner sleeve 23 of a tubular nozzle 24 also comprising an annular chamber 25 that encompasses the sleeve 23 and tapers toward the end of the duct 17 opposite the inlet end 19. The internal diameter of the sleeve 23 is not less than the external diameter of a single cigarette 2, and the chamber 25 connects at its tapered end with an intermediate part of the bore 21 by way of an annular port 26.

10       The nozzle 24 constitutes the actuator component of a pneumatic circuit 27 also comprising a source of compressed air 28, connected with the chamber 25 by way of a pipeline 29 and a valve 20, preferably solenoid operated, which is piloted to open by the sensor 14 through a conventional delay circuit 31.

15       The end of the bore 21 opposite the inlet end 9 is directed into a container 32 for collection of the cigarettes 2 removed from the chute.

20       During the pause between machine cycles, hence with the columns of cigarettes 2 stationary inside the

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channels 6, each sensor 14 monitors the condition of a respective cigarette 2 through the relative hole 15.

05 In the event of the cigarette 2 being substandard, the sensor 14 will proceed to operate the valve 30 by way of the delay circuit 31, whereupon the cigarette in question is removed.

10 More exactly, following a delay generated by the circuit 31 which is a function of the distance between the axes of the sensor 14 and the bore 21 (expressed as an equivalent number of machine cycles) the normally closed valve 30 receives an impulsive signal to open, and releases a jet of air at relatively high velocity through the annular port 26 in the direction of the container 32.

15 The emission of a high velocity airstream beyond the annular port 26 has the effect of setting up an impulsive and relatively hard dynamic vacuum in its wake. Given the dynamic nature of the vacuum thus generated, even a relatively small quantity of air released from the port 26 is sufficient to create instant negative pressure at the inlet end 19 of the duct 17, of an order such as will immediately pull the cigarette 2 from the channel 6 and propel it along the bore 21 toward the container 32.

The description of the device thus far implies no limitation; many variants might be adopted, without prejudice to the basic principle of the invention and without straying from the bounds of protection afforded by the claims appended.

05 For example, sensing means 14 might be fitted to each wall 4 and 5 of the chute 1 in order to verify the integrity of both ends of the cigarettes 2.

10 In the embodiment described above, where only one end of the cigarette 2 is monitored, the extraction duct 17 and the sensor 14 could be mutually aligned in such a way that monitoring and (if necessary) removal of the cigarette 2 can be effected in the same operating cycle.

15 In the example of fig 3, the extraction device 16 is designed to remove substandard cigarettes 2 from an amassment 33 in which the cigarettes 2 are laid parallel throughout, their opposite ends occupying two mutually parallel planes.

20 Such an amassment 33 can be conveyed from a forming machine to the infeed chute 1 of a packaging unit by conventional means, taking the form either of special containers, each designed to accommodate a given number of cigarettes, or a belt along which the cigarettes are carried in continuous strata.

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Whichever the type, such means are illustrated schematically in fig 3 as a simple deck 34, by which the amassed cigarettes 33 are supported. 35 denotes conventional sensing means mounted to a block 36, to which the extraction means 16 are also mounted, and directed toward the amassment 33 of cigarettes.

37 denotes a further block, carrying an upright bracket 38, and a lead screw 39 and a guide rod 40 of which the ends are fastened to the ends of the bracket; the screw and rod are likewise upright, and pass through the first block 36. The lead screw 39 is connected at bottom to a reversible motor 41 rigidly associated with the second block 37 and engages a lead nut associated with the first block 36, which can thus be made to ascend or descend vertically by causing the lead screw 39 to rotate one way or the other about its own axis.

42 and 43 respectively denote a lead screw and a guide rod passing through the second block 37, which are horizontally disposed and parallel one with the other, and supported by a bracket 44 rigidly associated with the frame (not illustrated) of the packaging unit.

The horizontal lead screw 42 engages a lead nut associated with the block 37 and can be rotated about its axis by a further reversible motor 45, mounted to the bracket 44, in such a way as to 05 traverse the second block 37, hence also the first block 36, horizontally left or right (as viewed in fig 3), according to the direction of rotation of the motor.

In operation, the integrity of the cigarettes 2 10 (accommodated by one of the special containers or carried along the belt, as the case may be), will be verified by the sensing means 35 as the relative block 36 is traversed vertically and horizontally by the motors 41 and 45, in the manner described in 15 application n 3525 A/88 for Italian patent.

In practice, the sensing means 35 will be coupled to a CPU comprising: an analyzer, in receipt of the image generated by the sensing means and capable of detecting and localizing circles in the image which 20 correspond to the ends of substandard cigarettes; and a comparator, by which each image received from the sensing means is set against a reference image, and in the event that the two images fail to match, capable of activating the control that operates the 25 extraction means.

The motors 41 and 45 are operated in such a way that the sensing means 35 can effect a complete scan of the amassed cigarettes 33 progressing toward the packaging unit, moving across the ends 05 preferably from top to bottom, and from left to right as viewed in fig 3.

**Claims**

- 1) An extraction device for the removal of single cigarettes from a plurality of cigarettes amassed parallel one with another and with their opposite ends occupying two mutually parallel planes, operating in conjunction with sensing means by which to verify the integrity of the cigarettes, characterized in that it comprises:
  - an extraction duct capable of alignment with a cigarette for removal, or with which the cigarette can be aligned, with its inlet end offered to one end of the cigarette;
  - a nozzle, discharging into the extraction duct in the direction opposite to that of the inlet end, and constituting part of a pneumatic circuit which further comprises a source of compressed air, and valve means located between the source and the nozzle and interlocked to the sensing means, in such a way that the valve means are piloted to open by the sensing means on discovery of a substandard

cigarette, connecting the nozzle with the source of compressed air and bringing about the removal of the cigarette by way of the extraction duct.

- 2) An extraction device as in claim 1, wherein the part of the duct into which the nozzle discharges affords a clear passage of internal section not less than the cross section of one cigarette.
- 3) An extraction device as in claim 1 or 2, wherein the nozzle is tubular in embodiment and coincides with a part of the duct.
- 4) An extraction device as in claim 1, operated in conjunction with means by which to support an amassment of cigarettes, comprising a block to which the device is mounted, and drive means by which the block can be positioned in relation to the amassment in such a way as to align the duct with any substandard cigarettes that are detected.
- 5) An extraction device as in claim 1, wherein the nozzle is located internally of the duct, near to the inlet end.

6) A device for extracting single cigarettes from an amassment of cigarettes, substantially as described in the foregoing specification and illustrated in the accompanying drawings.